present amendment.

In the outstanding official Action, Claims 15-18 were rejected under 35 U.S.C. §103(a) as being unpatentable over Radjai et al. ("Effects of Electromagnetic ...") in view of Vives ("Effects of Forced Electromagnetic Vibrations ...").

Claims 15 and 18 have been amended, and Claim 19 has been newly added herein. These amendments and addition to the claims find full support in the original specification, claims and drawings. For example, amended Claims 15 and 18 and new Claim 19 are supported by 11 pages, lines 2-6 and lines 14-16, of the specification, original Claims 1-10. Hence, these claims are not believed to raise a question of new matter.

Briefly, Claim 15 of the present invention is directed to a method for producing a refined microstructure of a metallic material and shifting a refined material to a periphery of a container to yield the refined material concentrated in an end portion of the metallic material, and the method includes subjecting the molten metallic material to a solidification process at temperatures lower than a liquidus of the molten metallic material, applying an electric current and a magnetic field simultaneously to the metallic material during a solidification process at temperatures lower than the liquidus of the molten metallic material to crush into small pieces solid crystals of the metallic material generated during the solidification process and to shift the small pieces to a periphery of the metallic material in the container, and yielding a refined microstructure of the metallic material concentrated in the end portion of the metallic material in the container. By applying an electric current and a magnetic field to the metallic material as such, a refined microstructure of a metallic material is produced and shifted to the periphery of a container and thereby the refined material concentrated in the end portion of the metallic material in the container can be yielded.

The outstanding Official Action asserts that "Radjai et al. substantially show the

invention as claimed except Radjai et al. do not disclose to crush solid crystals into small pieces during a solidification process at temperatures lower than the liquidus." However, not only Radjai at al. do not disclose to crush solid crystals into small pieces during a solidification process at temperatures lower than the liquidus, as mentioned in the Official Action, but also Radjai at al. do not teach applying an electric current and a magnetic field simultaneously to the metallic material during a solidification process at temperatures lower than the liquidus of the molten metallic material ... to shift the small pieces to a periphery of the metallic material in the container, and yielding a refined microstructure of the metallic material concentrated in the end portion of the metallic material in the container" as recited in amended Claim 15. On the other hand, Radjai et al. disclose "[s]uspended silicon particles multiplied in number with a reduction in size by vibrations at temperatures higher than the liquidus and agglomerated and repelled to the outer surface after the start of solidification." In other words, Radjai et al. simply disclose suspended silicon particles agglomerated and repelled to the outer surface.

Furthermore, according to Radjai et al., the suspended silicon particles are used and the particles are multiplied in number with a reduction in size by vibrations *at temperatures higher than the liquidus*, whereas according to Claim 15 of the present invention, solid crystals of the metallic material generated during the solidification process are used and the crystals are crushed into small pieces by applying an electric current and a magnetic field simultaneously to the metallic material during a solidification process *at temperatures lower than the liquidus* to shift them to a periphery of the metallic material in a container.

On those bases, it is respectfully submitted that the subject matter recited in Claim 15 is believed to be distinguishable from Radjai et al.

Likewise, Vives discloses effects of forced electromagnetic vibrations during the

solidification of aluminum alloys, but does not teach applying an electric current and a magnetic field simultaneously to the metallic material during a solidification process at temperatures lower than the liquidus of the molten metallic material ... to shift the small pieces to a periphery of the metallic material in the container, and yielding a refined microstructure of the metallic material concentrated in the end portion of the metallic material in the container" as recited in amended Claim 15. Thus, the subject matter recited in Claim 15 is also believed to be distinguishable from Vives.

Because neither Radjai et al. nor Vives discloses the applying and yielding steps recited in Claim 15, even the combined teachings of these applied references would not render the subject matter recited in Claim 15.

For the foregoing reasons, Claim 15 is believed to be allowable. Furthermore, since Claims 18 and 19 directly depend from Claim 15, substantially the same arguments set forth above also apply to these dependent claims. Thus, Claims 18 and 19 are believed to be allowable as well.

In view of the amendments and discussions presented above, the present application is believed to be in condition for allowance. Therefore, an early action favorable to that effect is earnestly solicited.

Respectfully submitted,

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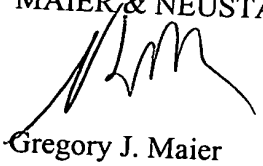

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IN THE CLAIMS

Please cancel Claims 16 and 17 without prejudice, and amend Claims 15 and 18 as follows:

--15. (Twice Amended) A method for producing a refined microstructure of a metallic material and shifting a refined material to a periphery of a container to yield the refined material concentrated in an end portion of the metallic material, comprising:

subjecting the molten metallic material to a solidification process at temperatures lower than a liquidus of the molten metallic material;

applying [a high energy vibration force including one of an electromagnetic vibrating force and an ultrasonic vibrating force] an electric current and a magnetic field simultaneously to the metallic material during a solidification process at temperatures lower than the liquidus of the molten metallic material[; and crushing] to crush into small pieces[, via impact pressure generated during collapse of the cavities,] solid crystals of the metallic material generated during the solidification process and to shift the small pieces to a periphery of the metallic material in the container; and

yielding a refined microstructure of the metallic material concentrated in the end portion of the metallic material in the container.

16. (Canceled)

17. (Canceled)

18. (Twice Amended) The method of Claim 15, wherein the electric current and the

magnetic field are [a high vibrating energy force is] applied simultaneously to the metallic material at temperatures lower than liquidus thereof during last stages of the solidification process.--

Please add new Claim 19 as follows:

--19. (New)--